10/089337
Rec'd PCT/PTO 27 MAR 2002

TEMPERATURE CHANGE POUCH WITH DISPENSING CHAMBER

INVENTORS: Kevin J. Fields, Gary C. Joseph, Piyush N. Zaveri

FIELD OF THE INVENTION

The present invention relates to a multiple compartment rupturable film reservoir capable of delivering a heated or cooled product. The invention may be used independently or as a subcomponent of another structure.

BACKGROUND OF THE INVENTION

Self-contained, self-heating/cooling devices that heat or cool through the use of an exothermic/endothermic reaction are known to the art. For example international patent WO 99/41554 discloses a multiple component heating cell that allows initiation of the exothermic reaction through the rupture of a single use frangible seal. Also, the use of rupturable sachets for containing and releasing product is known in the art.

However, it would be desirable to provide a relatively simple rupturable reservoir for applying a substance to a target surface that also is self-heating/cooling and readily manufactured and assembled. It may also prove useful to include this invention in other structures.

SUMMARY OF THE INVENTION

A product dispensing pouch formed from flexible film having at least a first compartment, a second compartment. Additionally, the pouch includes a third compartment containing a product. A first component contained in the first compartment, a second component contained in the second compartment, and at least one of the first and second components being flowable. In addition, the pouch has a first frangible seal located between the first compartment and the second compartment. The pouch is adapted to provide a temperature modifying reaction/event via the application of pressure to one or

both of the first and/or second compartments to rupture the frangible seal, and the pouch is adapted to dispense the product from the third compartment.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims which particularly point out and distinctly claim the present invention, it is believed that the present invention will be better understood from the following description of preferred embodiments, taken in conjunction with the accompanying drawings, in which like reference numerals identify identical elements, reference numerals with the same final two digits identify corresponding elements, and wherein:

Figure 1 is a plan view of a multi-compartment reservoir in accordance with the present invention;

Figure 2 is an elevational view of the multi-compartment reservoir of Figure 1;

Figure 3 is an elevational view of the multi-compartment reservoir of Figure 1 demonstrating the use of folding to properly locate compartments;

Figure 4 is a plan view of another multi-compartment reservoir in accordance with the present invention;

Figure 5 is an elevational view of the multi-compartment reservoir of Figure 1 demonstrating the use of folding to protect the frangible seals;

Figure 6 is a plan view of cells as would be created on a vertical form/fill/seal machine;

Figure 7 is a plan view of a preferred embodiment of a semi-enclosed heating/cooling applicator in the form of a mitt in which the present invention represents a sub-component;

Figure 8 is a cross-sectional view of the mitt of Figure 7 taken along line 8-8;

DETAILED DESCRIPTION OF THE INVENTION

As used herein, the term "disposable" is used to describe multi-compartment reservoirs that are not intended to be restored or reused (i.e., they are intended to be discarded after a single use or a limited number of uses, and preferably, to be recycled, composted or otherwise disposed of in an environmentally compatible manner).

Reservoir Constructi n and Operation:

A representative embodiment of the multi-compartment reservoir of the present invention is shown in Figure 1. Figure 1 is a plan view of the reservoir 326 of the present invention in its flat-out state illustrating the reactant containing compartments 322 and 320 and the product dispensing compartment 318.

Product Dispensing Compartment(s):

As shown in Figure 1, the product dispensing compartment 318 contains a product that may be dispensed and/or dispersed for delivery to a target surface. The product dispensing compartment 318 may be of any suitable size, configuration, and composition for the intended product to be dispensed and dispersed. The product may be a liquid, a gel, a lotion, a cream, a powder or even a solid. A solid such as a wax, for example, could become a flowable product that may be dispensed and/or dispersed from the product dispensing compartment 318 once heated. The product dispensing compartment 318 can be designed to burst or rupture to release the product contained within the reservoir at a comparatively low force when desired by the consumer. This may be accomplished by having a sealed pouch with permanent seals 312 and also seals that are "frangible" 314, i.e., rupturable. When the pouch is squeezed, the frangible seal 314 will yield or fail first since it has a lower peel force to break the seal apart than the permanent seals. In one embodiment, the frangible seal will ideally rupture with 1-3 lbs of force when applied by the consumer. The product dispensing compartment 318 is further defined by having at least one exit location 316. The product dispensing compartment may use some means other than a frangible seal for dispensing such as a pull tab, a perforated tear strip, a tab that may be cut off, or a crimping device that may be removed to release product, or it may be rendered rupturable by means other than frangible seal such as laser scoring or a weakened region.

Adding stress concentrators in the seal geometry that will localize forces at a particular location can optimize the location of rupture. These stress concentrators can be shaped like a V, a notch, a half circle or a variety of other shapes depending upon the desired burst level. These stress concentrators will help control the force required to burst the pouch as well as the location of where the seal will rupture. Such stress concentrators thereby focus or concentrate external pressure or mechanical forces imposed on the reservoir and its contents. For example, in Figure 4, pressurizing the product dispensing compartment 518 having a V-notch seal 502 will localize forces first at the apex of the V,

causing that region to rupture first. Such an arrangement can help reduce potential variability in rupture or dispensing forces and the location where the rupture occurs. Additionally, seal angles and geometries of the seal can also be used to tailor dispensing forces for particular applications. A stress concentrator, such as the V-notch frangible seal 502 in Figure 4, could also replace frangible seal 324 between the heating/cooling compartments 320 and 322 of reservoir 326 in Figure 1.

More advanced product distribution functionality may be designed into the product dispensing compartment 518 as detailed in Figure 4. The bursting pouch may also have an integral distribution head (such as illustrated as channel 550 of reservoir 526 in Figure 4) that allows the product to be dispensed and dosed to different locations. This distribution head is ideally an extension of the pouch material that has been sealed in a way to form channels for the product to flow to another region. The distribution head may have holes in the sides for the product to exit or may have several seals that force the product to change direction minimizing the velocity of the product exiting and thus eliminating or reducing uncontrolled spraying of the product out of the mitt. Other arrangements, such as the inclusion of baffling structure 552, as shown in Figure 4, to divert or control the fluid might be desirable as well, such as where products of low viscosity are dispensed. The baffling structure 552 slows product release by changing the direction of the product flow and providing exit locations 516 larger than the delivery channel 550. This particular embodiment utilizes a seal 552 in the center that acts as a baffle to prevent product from exiting too quickly or with too much force and running off the substrate. The end 516 is not sealed and serves as the exit location.

The channel 550 of the reservoir 526 of Figure 4 may be of a material and configuration such that it is "self-sealing" and collapses shut to restrict, if not preclude, fluid flow except when the chamber is substantially pressurized. For example, a channel 550 may be formed by making two substantially parallel seals along facing layers of a pouch, where the space between these seals becomes a channel for fluid to move from the reservoir to the distribution aperture(s). The channel will naturally lay flat (and thereby closed) due to the seals, but will become almost tubular when the reservoir is pressurized and filled with fluid traveling through the channel. Upon release of the pressure, the channel will tend to naturally return to its flat state, causing a sealing effect to prevent further product delivery. The dimensions of the channel may be optimized based upon the viscosity of the product being dispensed from the reservoir. For example, a reservoir

designed for dispensing a powder or a relatively thick lotion or cream product will preferably have a wider channel than a reservoir designed for dispensing a relatively lower viscosity product such as a predominantly water-based or alcohol-based product. In one embodiment containing product with about the viscosity of water, the channel width is preferably in the range from about 0.125 inches to about 0.5 inches wide, more preferably about 0.25 inches, to allow "resealing" of the channel while not requiring excessive force on the pouch to pressurize the channel. Resealing of the channel may provide for dosing or progressive fluid dispensing.

Additional functionality may be provided to allow proper dosing. Figure 4, for example, shows additional features for controlling dosing. Areas 556 of the lock up seal aid in the prevention of over-dosing by inhibiting fluid flow through the dosing channel once activated. Thus, the user feels an increase in resistance when squeezing or pressing the pouch. Areas 558 are preferably not sealed and extend beyond the end of the dosing channel. Once the product dispensing compartment 518 is pressurized, these areas 558 fill and provide a more rigid three-dimensional structure to the reservoir and prevent the channel from folding and clamping shut. Areas 560 of lock up seal can be added to provide a "target zone" for the frangible seal. Thus, burst force consistency is improved by limiting the width 562 of the frangible seal 514 and manufacturing is made easier by having a larger zone 564 where the frangible seal can be located. Area 560 also aids in forming a natural fold line for protecting the frangible seal.

Figure 4 also depicts another product dispensing compartment 554 for containing product that is separated from compartment 518 by frangible seal 552. The compartments may contain products of the same, similar, or diverse compositions, and may be designed to be ruptured sequentially or simultaneously depending on how pressure or squeezing is applied by the user. Many more and complex arrangements of compartments and seals of varying strengths are possible.

The layout, products, and features of the product dispensing compartment may be similar to those described and illustrated for the "fluid reservoir" in Co-pending United States Application Serial No. __________ entitled "Dosing Applicator for Distributing a Substance Onto a Target Surface" filed by Dana P. Gruenbacher et. al. on October 9, 2000 (P&G Case No. 8166M), which is incorporated by reference.

Heating/Cooling Compartment(s):

In Figure 1, the heating/cooling compartments 320 and 322 make up an exothermic or

endothermic system that provides a heating or cooling effect, respectively. The systems may include heating/cooling by, but not limited to, an anhydrous reaction, heats of solution, oxidation reactions, crystallization, corroding alloys, zeolite-liquid systems and/or pH swings.

One embodiment of a heating/cooling element may include a solid-liquid or liquid-liquid heating/cooling system, such as an anhydrous reaction system, a heat of solution system, a zeolite system, an electro-chemical system, etc. A solid-liquid heating/cooling system includes any system in which an exothermic or endothermic change occurs during the combination or mixing of two or more components where at least one component is substantially liquid in nature (e.g., water) and at least one component is substantially solid in nature (e.g., anhydrous salts). A liquid-liquid heating/cooling system includes any system in which an exothermic or endothermic change occurs during the combination or mixing of two or more components where two or more of the components of the system are in a substantially liquid form.

The outer perimeter of the pouch and the seal between the product reservoir portion 318 and one of the heat generating components 320 can be permanent seals 312. Alternatively, on of the perimeter locations may be the fold of the material 325. The exothermic or endothermic component portions of the pouch are shown as compartments 320 and 322 and are separated by a frangible seal or other rupturable barrier 324.

In order to heat or cool a product within compartment 318, the heating/cooling compartments 320 and 322 may be located in intimate contact with the product dispensing compartment 318 to allow for efficient conductive heat transfer. This may be accomplished by placing the product dispensing compartment 318 and either or both of the heating/cooling compartments 320 and 322 in contact adjacent or close proximity to each other. The pouch can be folded between the product reservoir portion 318 of the pouch and the adjacent exothermic or endothermic component compartment 320 of the pouch 326 such as shown in Figure 3. In some embodiments, the product dispensing compartment 318 and the heating/cooling compartment 320 may be adhered together when folded with an adhesive or other bonding method known in the art. Thus, for simultaneous activation of the heating/cooling element and release of a product, compartment 320 can be filled with a liquid first component and compartment 322 can be filled with a liquid or solid second component. For activating the heating/cooling element and releasing the product from the product dispensing reservoir 318 sequentially or at different intervals, such as to heat / cool

the product in the product dispensing reservoir 318 or to heat/cool a target surface before or after the product is dispensed from the product dispensing reservoir 318, compartment 320 can be filled with a solid second component and compartment 322 can be filled with a liquid first component. For liquid-liquid systems or as an alternative to the previously mentioned method, sequential activation of the heating/cooling compartments 320 and 322 and release of the product from the product dispensing compartment 318 may be accomplished with the same orientation as previously mentioned for simultaneous activation, but where the seal strengths of the frangible seal 324 located between the compartments 320 and 322 and the frangible seal 314 of the product reservoir portion 318 are different. In this embodiment, one seal can activate at a lower squeeze force than the other, and the user would merely squeeze less to burst one of the frangible seals and then squeeze harder to burst the other. Furthermore, the product dispensing reservoir 318 could be located away from the activation portion of the heating/cooling compartments 320 and 322.

In some embodiments, it may also be desirable that the product exit from the product dispensing compartment 318 onto the heating/cooling compartments 320 and/or 322. For example if the mass of the product released is small, the temperature of the product may change in temperature quickly as it is applied to a cooler surface. If the product is released onto the heating/cooling compartments, however, the heating/cooling compartments may be pressed against the target surface as the product is applied. Thus, the actual contact of the heating pouch 302 to the surface may provide an additional conductive heating/cooling effect. Actual product exit location may be controlled by product dispensing compartment design, distance between compartments 318 and 320, and fold location between compartments 318 and 320.

It may also be desirable to add additional functionality to the heating/cooling compartments. Such features are demonstrated in Figure 4. For example, areas 504 of the lock-up seal would allow the reactant contained within compartment 522 to pass through to compartment 520 for mixing when compartment 522 is pressurized and frangible seal 524 has broken. However, when pressure is released, areas 504 would prevent or hinder the reactant from flowing back in to compartment 522.

Figure 4 also demonstrates one way of providing a three component heating/cooling system. An additional compartment 510 is added with additional frangible seal 506.

Further layouts, reactants, and features of the heating/cooling compartments may be similar to those described and illustrated in Co-pending United States Application Serial No. __________ entitled "Product Dispenser Having Internal Temperature Changing Element" filed by Gary C. Joseph and Piyush N. Zaveri on October 9, 2000 (P&G Case No. TOM1), which is incorporated by reference.

Materials and Seal Protection:

The hermetically sealed reservoir(s) in the applicator preferably use sufficient barrier materials to allow these individual applicators to have multi-year shelf life even when stored as individual units. The reservoir preferably uses a laminate film that contains either metallized PET, aluminum foil, SiO_2 or some other high barrier material that will provide an adequate moisture and/or oxygen barrier to allow the product to have a reasonable shelf life. In one embodiment, for example, the reservoir may have a shelf life in the range from about 2 years to about 3 years. Smaller reservoirs with small amounts of a product require even a higher barrier since the surface area to volume of fluid is significantly higher resulting in higher levels of moisture loss due to transport and diffusion.

The reservoirs can be made rupturable or "frangible" by a number of different techniques. One preferred technique is to make a pouch on a vertical or horizontal form/fill/seal machine that has the ability to make different seals on the pouch at different temperatures, pressures or seal times. This allows one area of a pouch to have different sealing conditions that in turn can allow that area to have a weaker seal strength. A suitable sealant material for this type of "frangible" seal would be Surlyn® made by Dupont or a blend of Polybutylene with Ethylene Vinyl Acetate or ultra low density ethylene copolymers, polyolefin plastomers, and/or Polyethylene. Sealant layers made with either of these resins or blends will result in a sealant layer that will have significantly different seal strengths depending upon the seal temperature. The blend provides a "contaminant" to the base polymer material that allows the resulting seal to be selectively frangible under certain sealing conditions. For example, at 200 degree F the sealant layer will deliver a seal force of 200-400 grams/linear inch of seal width and at 300 degree F the seal force will deliver a seal force closer to 3000 grams/linear inch of seal width. This variation in seal strength allows a pouch to be "welded" shut in one portion and easily burstable in a second portion just by adjusting the seal temperature, the seal time and/or the seal pressure used when making the pouch seals (e.g., the pouch may be welded along all or a portion of one, two,

three or more sides and easily burstable along a portion of one, two, three or more sides). A preferable film structure for this type of frangible reservoir would be Surlyn® sealant/tie layer/metallized PET. Other techniques for making the consumer activated rupturable reservoirs include delaminating seals, weak regions in the film structure such as created by embossing, laser scoring, mechanical scoring or other known methods of weakening a film structure, and small thermoformed cells with thin regions that rupture when squeezed (similar to bubble wrap).

One aspect of the product dispensing compartment 318, in Figure 1, and reactant compartments 320 and 322, which is believed to be important to the overall functionality of the reservoir, is the ability of a sealed, fully-enclosed reservoir to rupture or otherwise dispense the product contained therein when "activated" by the user and yet resist premature dispensing during manufacture, packaging, and shipment. The ability of the reservoir to survive intact until the point of use preserves the quality and quantity of the liquid until the time of use. In some embodiments, the pouch is able to rupture at a relatively low force, such as in the range from about 1 pound to about 3 pounds, when the consumer is ready to use, but the pouch is able to survive relatively higher forces, such as in the range from about 10 pounds to about 40 pounds, when the mitt is in distribution to the store or handled in the box on the store shelf. This can be accomplished by folding the pouch on the frangible seals or between the frangible seals and the compartments such that there is a mechanical advantage that occurs preventing the pouch from bursting and generally protects the pouch from undesired rupture and premature fluid dispensing. In some embodiments, for example, this technique has been shown to effectively raise the bursting force to a level in the range from about 30 pounds to about 40 pounds. When the pouch is assembled into another structure this can be accomplished by folding the finished structure into a compact unit, which also aids in packaging and shelf display.

In Figure 1, to protect both the product dispensing compartment 318 and the heating/cooling compartments 318 and 320, the frangible seal 314 of the product dispensing compartment 318 and the frangible seal 324 separating heating/cooling compartments 320 and 322 could be located in close proximity or at list in a linear situation such that a single fold bends both product dispensing compartment 318 and heating/cooling system at their respective frangible seals. Figure 5 is an elevational view of the reservoir 326 of Figure 1 and illustrates the use of folding techniques to protect the multiple frangible seals from premature rupture. It is also possible to protect both frangible seals if not in

close proximity or linear by creating multiple folds that include each frangible seal that it is desired to protect. Folding the reservoir in effect crimps, or pinches off, the fluid pathway and is capable of withstanding significantly more internal pressure without leakage than would normally be desired for the frangible or rupturable seal relied upon for dispensing functionality.

Another means of reducing pre-mature bursting is the use of a secondary crimping devices that "clamp" the frangible seals and prevent pre-mature bursting until the crimping devices are removed. The crimping devices could be a low cost injection molded part such as a flexible clip or paper clip-like structure. The crimping device should have enough biasing force to keep the pouch in a generally flat condition adjacent the frangible seal or any region where protection from bursting is needed.

Manufacture:

The invention is particularly well suited for ease of manufacture. Similar reservoirs have been created on a vertical form/fill/seal machine capable of simultaneously creating seals of varying strengths by varying seal time, temperature, and/or pressure to create both lock-up seals and frangible seals at desired and possibly varying seal strengths. Figure 6 details a preferred method of manufacturing the reservoir 326 of Figure 1. The vertical form fill seal machine may combine two films or a use a single film folded as detailed in Figure 6. Each compartment may have a dedicated fill tube. Thus, in one embodiment, compartment 322 would contain magnesium sulfate; therefore, fill tube 602 would represent a powder auger capable of transporting controlled amounts of powder. A fluid reactant such as water could be filled in compartment 320 through fill tube 604. Fill tube 606 would transport the appropriate product to compartment 318. Fill volume can be controlled by compartment geometry as well as the height of the column of fluid maintained. For example, raising the height of the column 608 of the fluid loaded into the product dispensing compartment will increase the final fill volume. Conversely, lowering the height of the column 608 will decrease the fill volume. If height of the column 608 is greater than the seal point, the material selected for the reservoir will have to be capable of sealing through the particular product or component.

A crease, perforation, or other deformation 610 may be created to aid in folding of the product dispensing compartment 318 onto the heating/cooling compartments 320 and/or 322. It is possible for a modified vertical form/fill/seal machine to create this deformation, apply an adhesive, and fold the reservoir.

Example 1

As shown in the plan view presented in Figure 7, a possible two-finger mitt 558 for applying a heated moisturizer to the face is demonstrated using a combination product releasing pouch and heat producing pouch 326 similar to that shown in Figure 1. As shown in the cross-section Figure 8, the top panel 564 could be constructed of a 62 gsm hydroentangled nonwoven of 75% polyester and 25% rayon. This structure would slow product release once the pouches have been ruptured by limiting product escape, and it would also provide an exfoliation benefit to the skin as outer surface 570 rubs across the face during application. The pouch may be folded between the product compartment 318 and reactant compartment 320 such that compartment 318 rests on compartment 320 when assembled into the mitt; this arrangement is shown in Figure 3. The pouch would preferably be oriented in the mitt such that compartment 322 was closer to the finger tips than 320. Compartment 320 would preferably contain 1 gram of water (H_2O) and compartment 322 would contain 1 gram of magnesium sulfate ($MgSO_4$). Frangible seal 324 of reservoir 326 shown in Figure 1 may sealed under conditions such that it would rupture with less force than frangible seal 314. Thus, when squeezed by the user, the visible cue supplied by product release from compartment 318 would not occur unless the heat-producing reactants were allowed to mix. Because of the pouch arrangement and orientation, the product from the pouch 318 would be expelled and would rest on compartment 322. Thus, because the heating area, the location of product expelled, and location of the user's fingers, the heat cell heats the product and also the user's skin as it is pressed and rubbed against the face. The barrier layer 566 could be 5 mm thick open-cell polyurethane foam to prevent product from reaching the fingers and to also insulate the fingers from uncomfortable levels of heat. Furthermore, the barrier layer prevents the tactile properties of the product released from compartment 318 from being noticed by the user. Finally, in Figure 7, the backsheet 568 could be constructed of 20 GSM carded polyethylene nonwoven. The cross machine direction of the nonwoven may be oriented such that it is perpendicular to the length of the users fingers when placed on the hand. This allows the mitt to accept a variety of finger sizes since the strength in the cross-machine direction is less than that of the machine direction of the nonwoven; thus, the backsheet stretches to accommodate the user's fingers. To use the applicator, the user merely presses the applicator on pouch 318 to release the product and simultaneously

activate the heating pouch. The user then applies the product to the face by rubbing against the skin.